

Three Different Approaches to Bx Imaging

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AS&E[®]

Detect the **difference.**

Introduction: AS&E Company Overview



Number 1 Supplier of Vehicle Detection Systems

AS&E manufactures X-ray security systems to inspect vehicles, containers, parcels, baggage and people for IEDs, weapons, narcotics, and other threats

Z Backscatter is AS&E's signature X-ray technology and a proven imaging technique for the discrimination of organic materials, such as explosives

Over 400 Z Backscatter Systems have been sold worldwide – the U.S. Government owns and operates about half of these, including 150+ with the U.S. Department of Defense

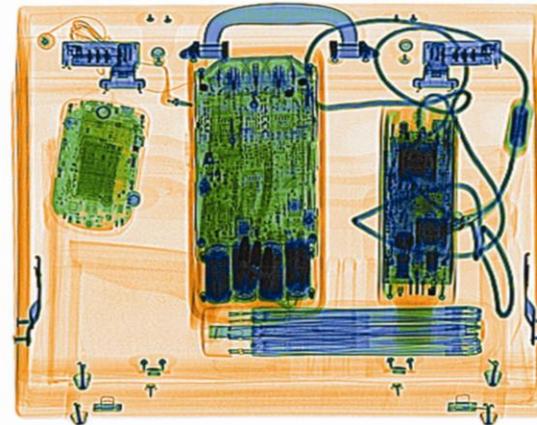
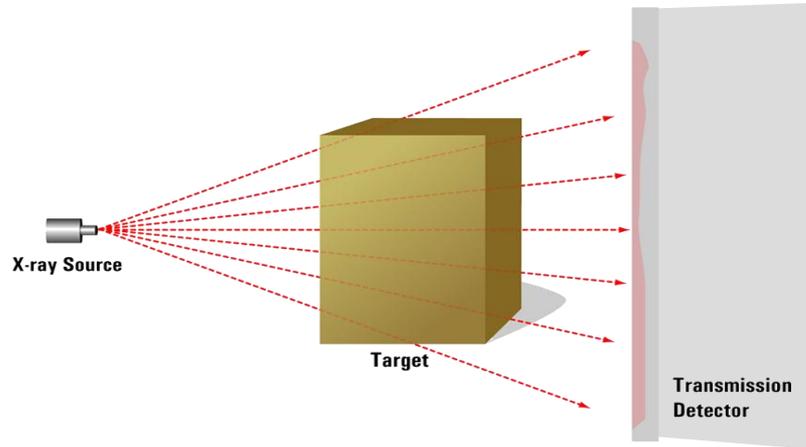


AS&E AT A GLANCE

CORPORATE HEADQUARTERS Billerica, MA • **FOUNDED** 1958 • **EMPLOYEES** Approx. 400
BUSINESS X-ray Screening & Inspection • **Revenue** Approx. \$200M • **STOCK** NASDAQ: ASEI

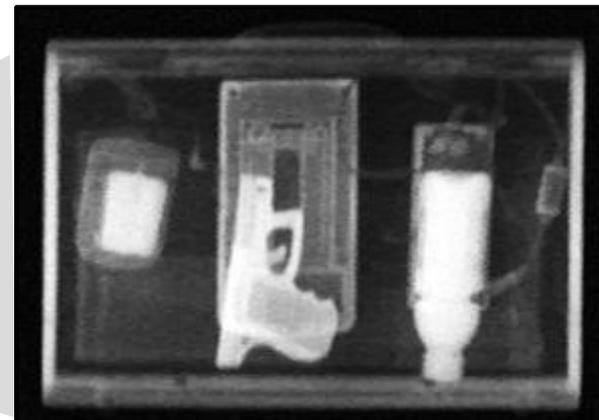
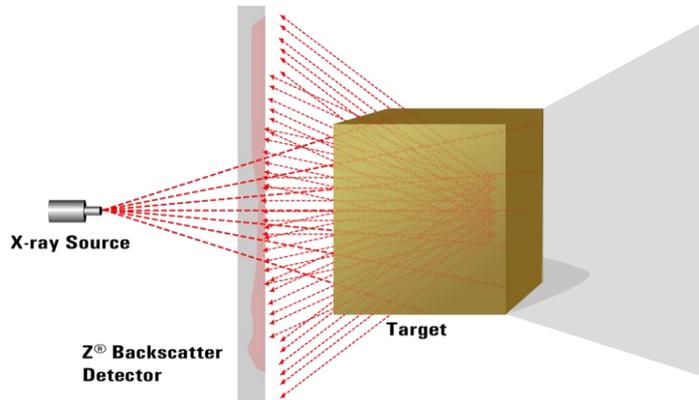
Introduction: Types of X-ray Imaging

Transmission X-rays image by passing an X-ray beam through a target to a detector on the far side.



TRANSMISSION X-RAY

Backscatter X-rays image by reflecting an X-ray beam from a target to a detector on the near side, creating a photo-like image that is easy to interpret and understand



Z BACKSCATTER X-RAY OF THE SAME SUITCASE

Introduction: What is an X-ray and how are they made?

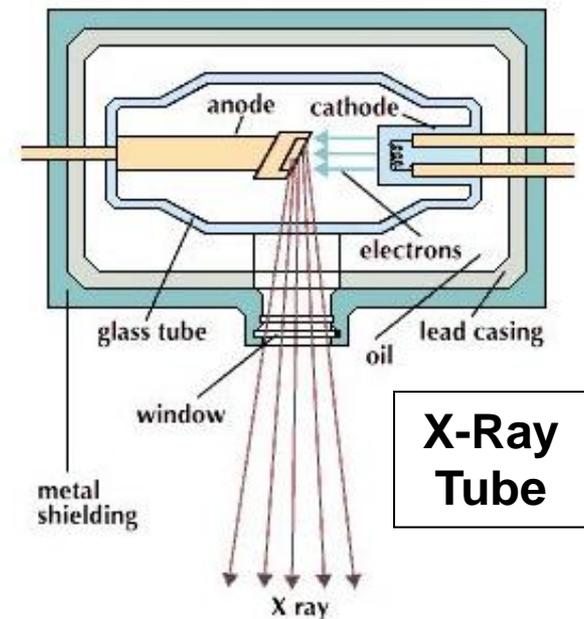
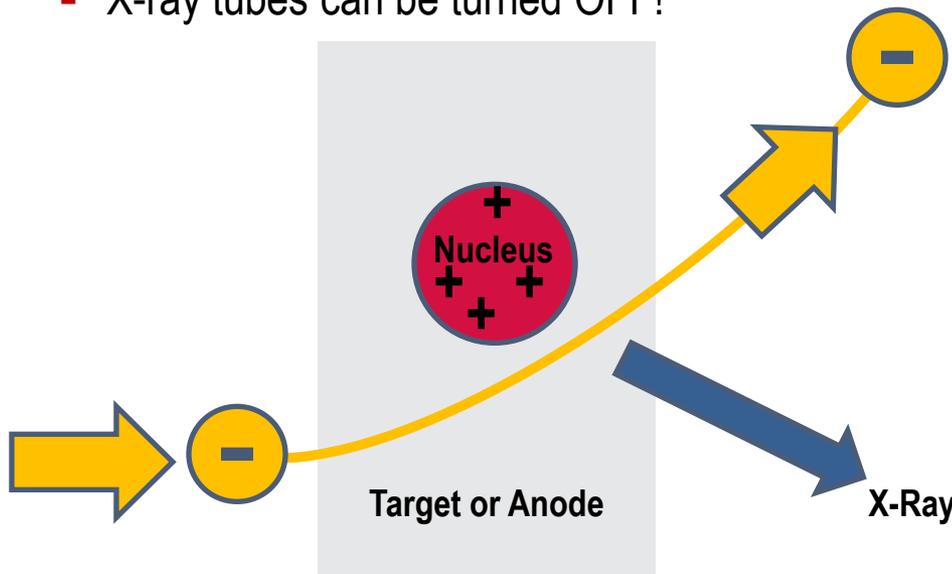
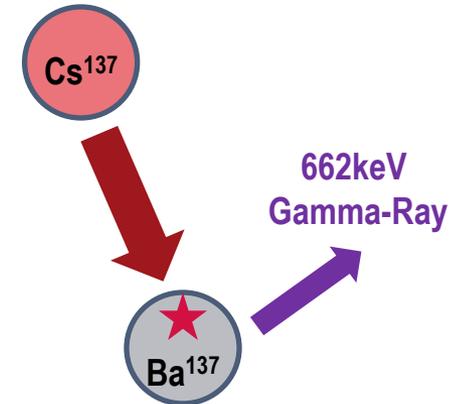
What is a Gamma-Ray?

- A Gamma-ray is a very-high energy photon which is produced when a radioactive nucleus decays to a state of lower energy
- Mono-energetic (single energy)
- Can have energies of a few million electron volts (MeV)

What is an X-Ray?

- An X-ray is a high energy photon that is produced when a high velocity electron experiences an acceleration
- X-rays are usually polychromatic (many energies)
- X-ray tubes can be turned OFF!

Radioactive Nucleus



225 kV

Z Backscatter Van

Mobile Z-Backscatter Van « ZBV »

- Built on standard Mercedes Sprinter chassis
- 1 scan direction
- 225 keV X-ray source
 - 13 mA (3000 Watts)
- Scanning speed : up to 10km/h
- Great detection capabilities
 - Organic material
 - Explosives
 - Drugs
 - Radioactive products and sources
 - Smugglers
 - Smuggled goods (Cigarettes, etc.)
- Stationary or Mobile operating modes
- Safe for humans and cargo



ZBV with Customs at a Border Crossing

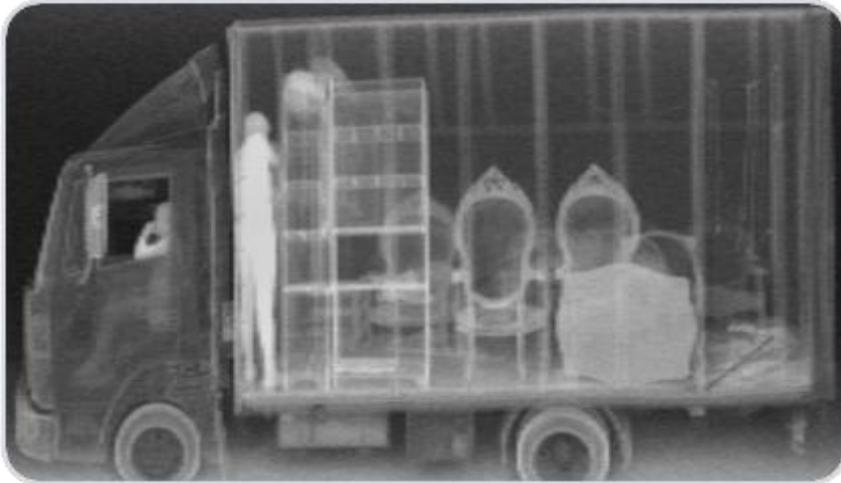
Drug Seizure



- Conops for one Customs agency
 - Ten passenger vehicles selected for secondary inspection are instructed to park along a row of cones
 - ZBV scans one side of the vehicles and then the other side
 - Two officers operate the ZBV—One drives and one analyzes the images in real time

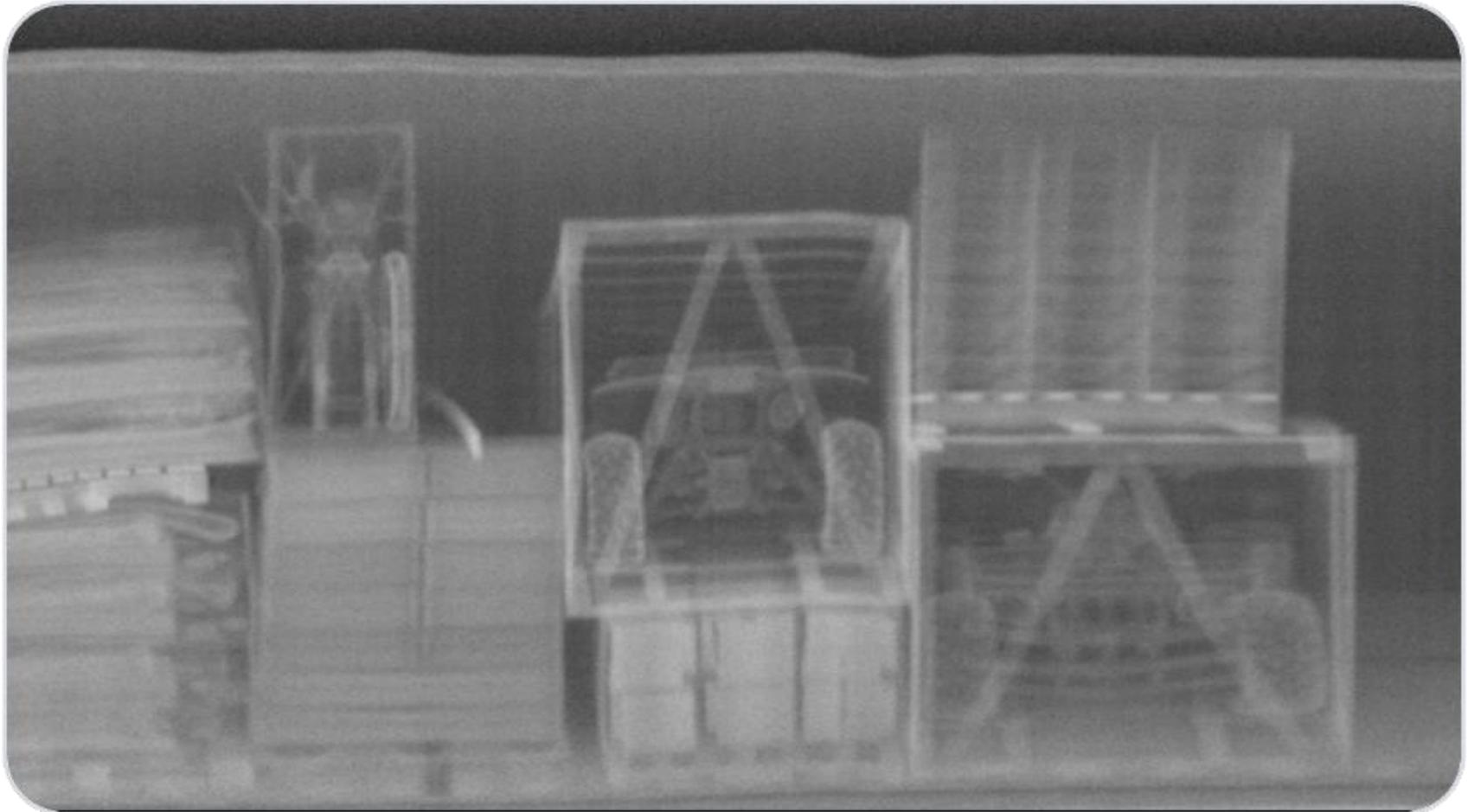


ZBV Stowaway Images

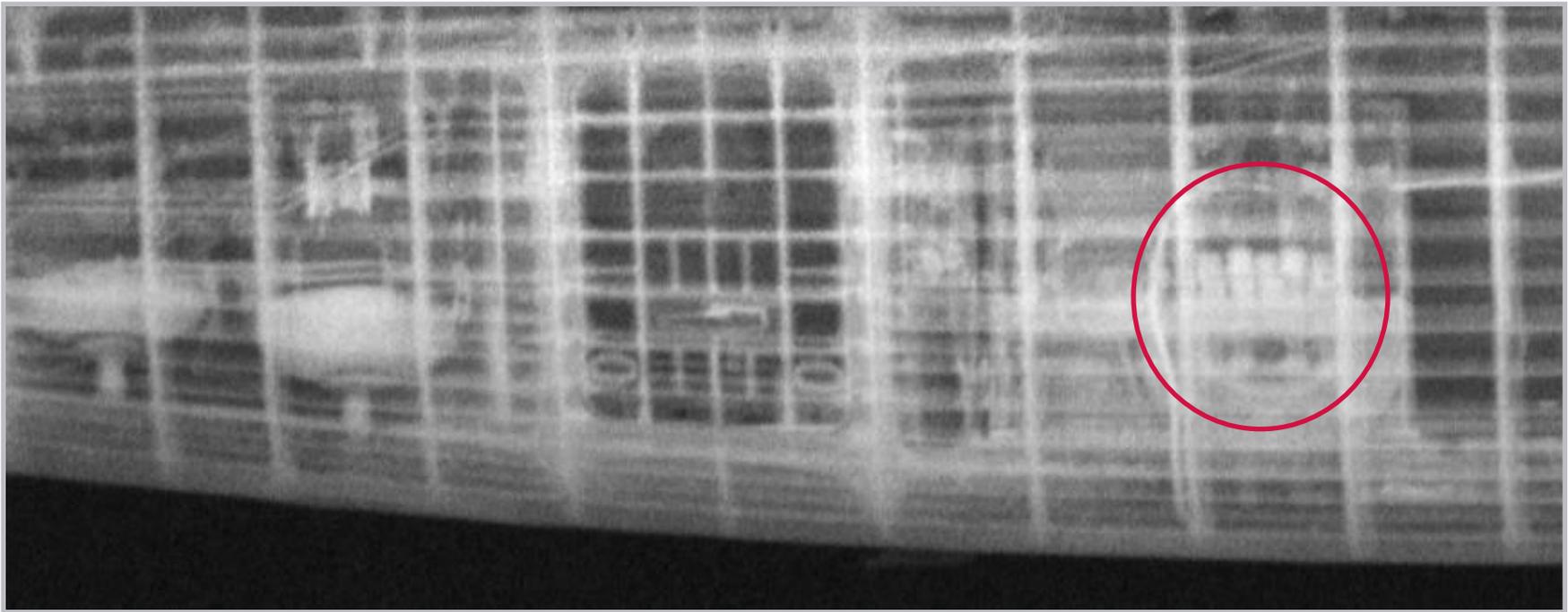


ZBV: Image of ATVs in a Container

225 kV is sufficient X-ray penetration to take backscatter images through standard ISO containers (4 mm steel)



ZBV: Screening 767-300ER – Actual Drug Seizure

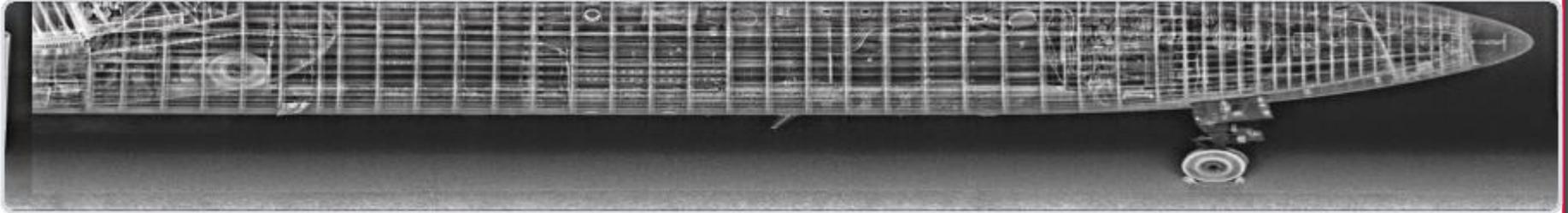


Backscatter technology is highly effective at screening aircraft

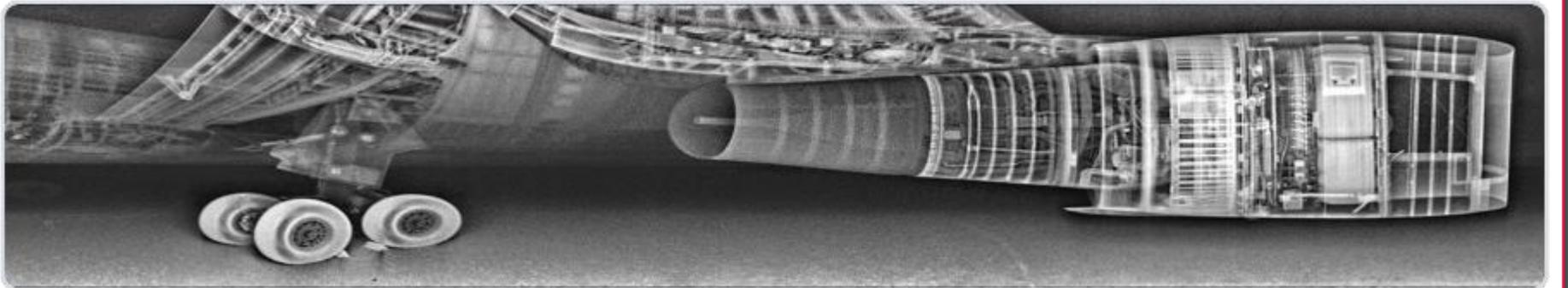
ZBV can be used to screen aircraft for concealed items

- Contraband such as narcotics
- Explosives / IEDs

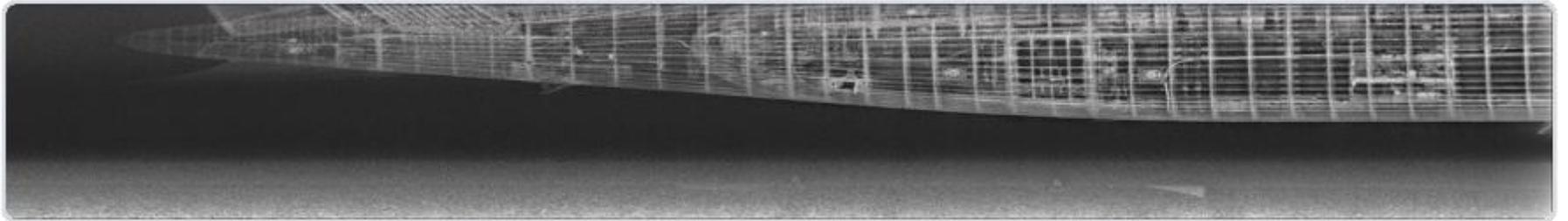
ZBV: Aircraft Scanning: 767 in 3 Sections



Forward Section



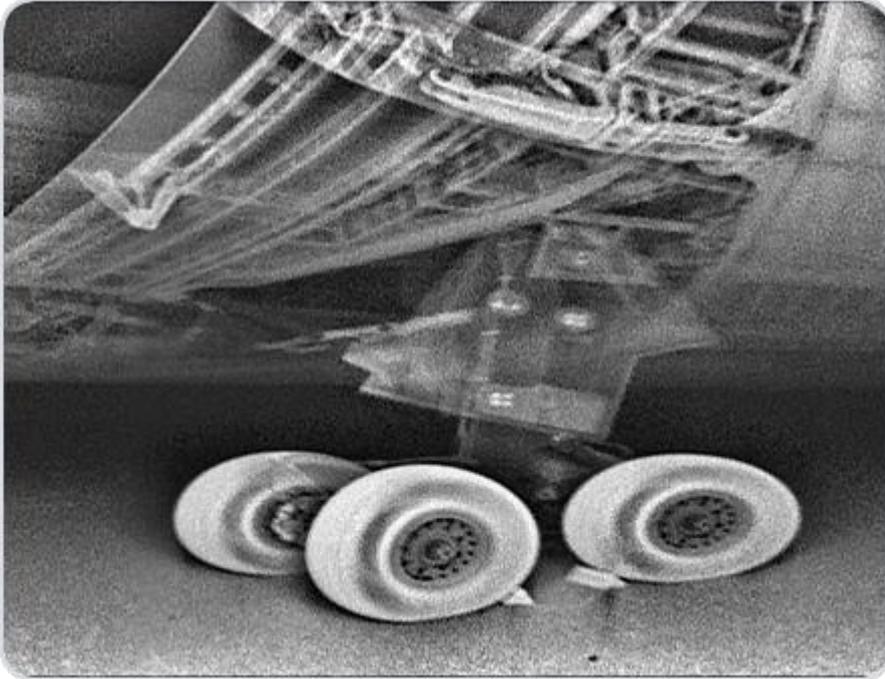
Engine



Rear Section

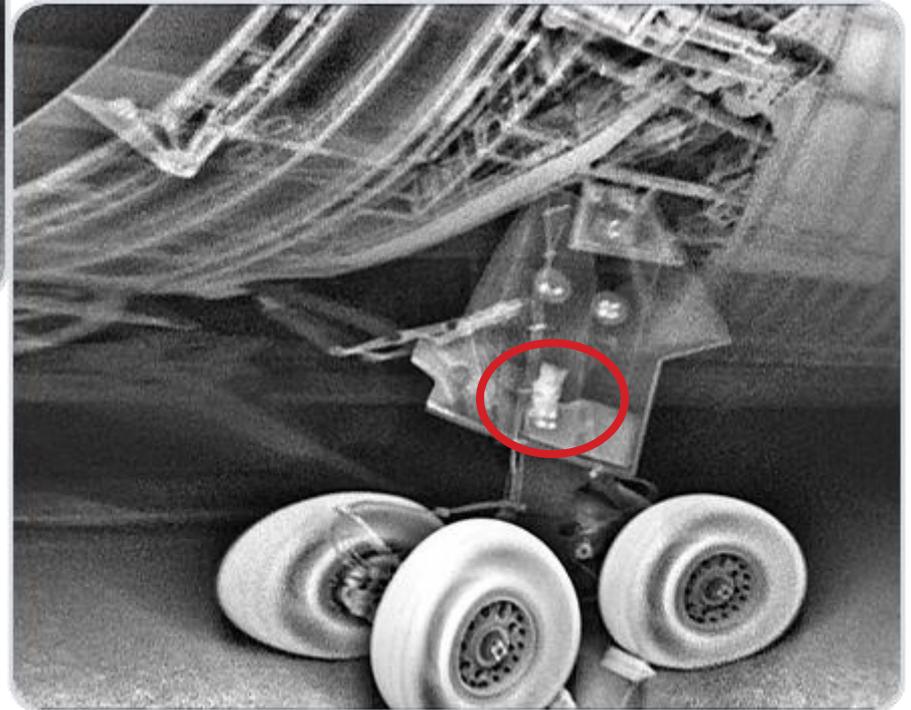
ZBV: Screening 767

Threat on Gear



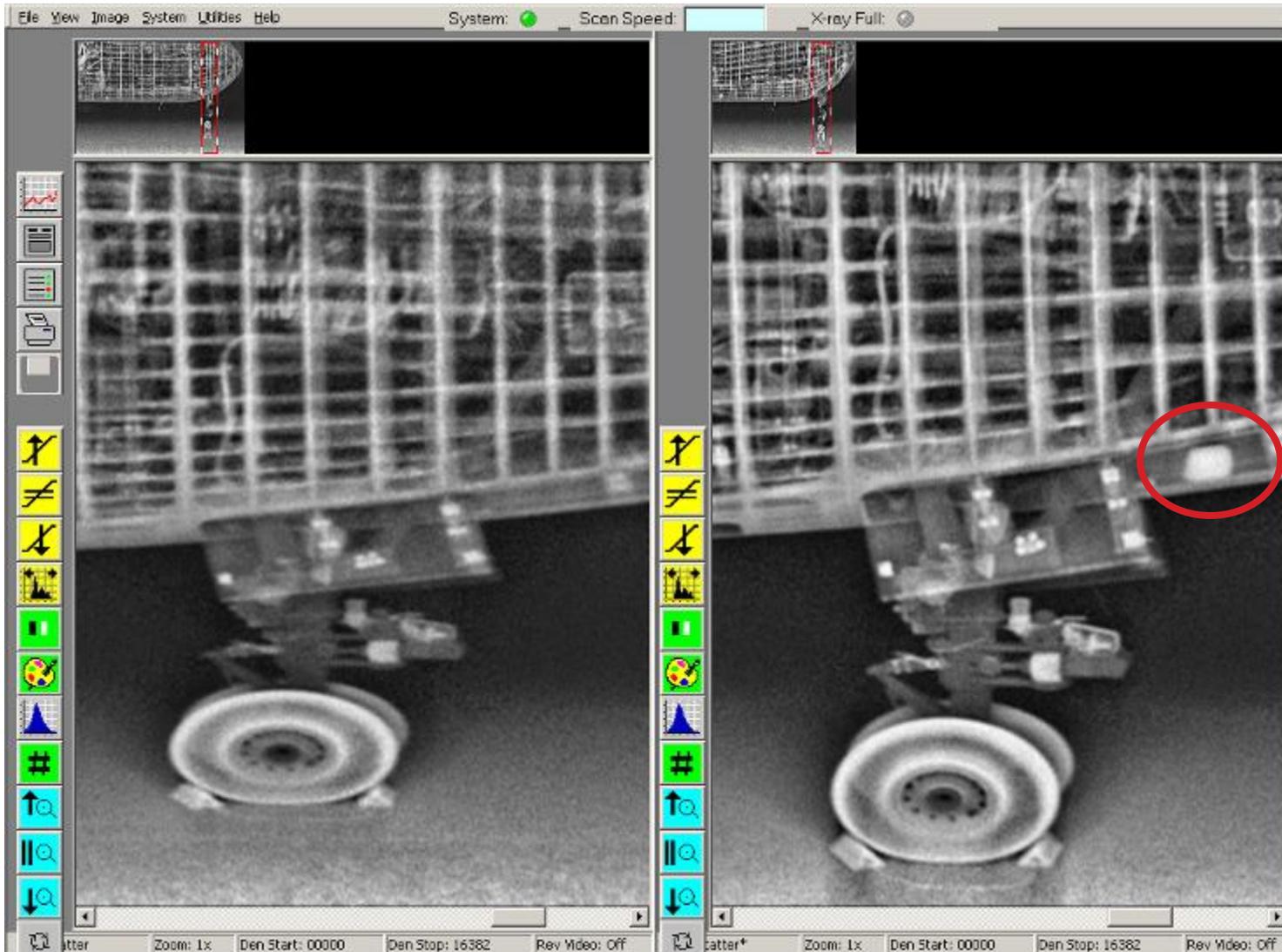
No threat

2 lbs organic explosive
simulant



Historical Compare Tool with Threat in Front Fuselage

Can be used to compare images of known “clean” aircraft



140 kV

AXISS Robot Towed (RT) Configuration

Weight of box: ~300 lbs (135 kg)

Scan time: varies 60 to 180 seconds

Size: 25" x 28" x 25" (64 cm x 71 cm x 64 cm)

Designed for Bomb Squad use

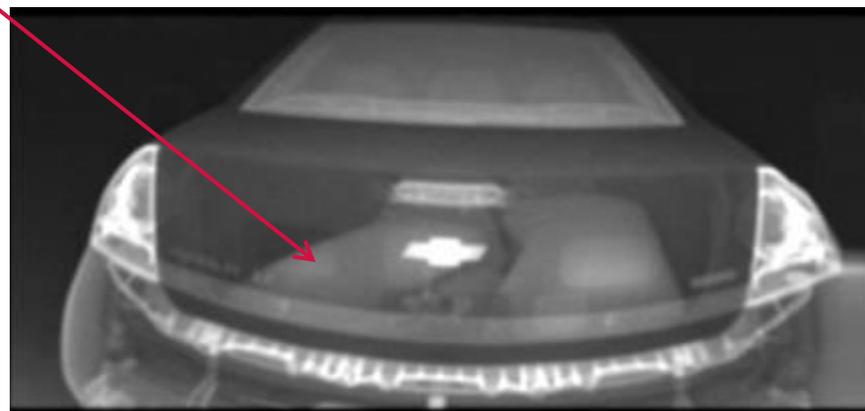
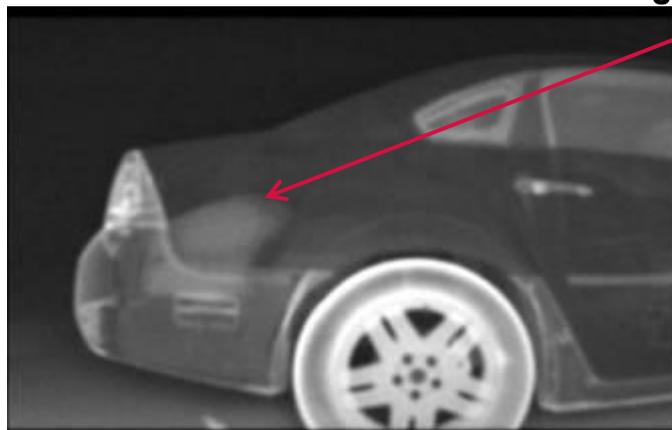
- Analysis of potential VBIEDs
- Abandoned Packages

Towable by a bomb squad robot to provide remote imaging capability

Includes onboard batteries, a lift, and an Ethernet radio



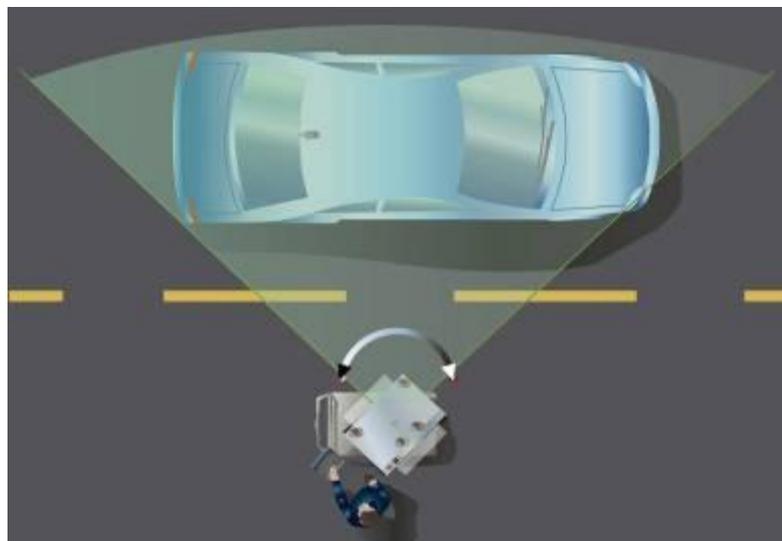
50 lb bags ANFO Simulant



AXISS: Key Differences from ZBV

X-ray source is 140 keV and 3-6 mA, around 1/6th the power of the ZBV.

System provides its own scan motion through Curvilinear Scanning: Turret rotates horizontally while scanning



Field of View: Vertical +/- 42° and the source can rotate to look down or up

Middle:
Main viewing angle



Bottom:
Useful for looking at objects close up (<3 feet (1m)) that are on the ground (e.g. suitcase)



Top:
Useful for looking at very tall objects (e.g. truck trailer)





VBIED – 25 Lbs Threat Material in Passenger Door (24” from Target)

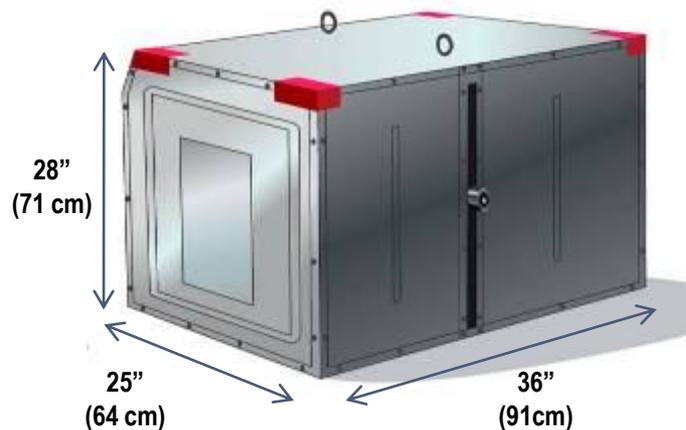


AXISS: Modular System Mounted on Motorized Cart

Weight: ~450lbs (210 kg) (imaging system only)

X-ray source 140 keV, 6 mA

Scan time: varies 15s – 2 minutes



AXISS: Modular Deployment Mechanism



Powered Cart: push cart, powered by battery

Powered lift

Size (with imager): 29" w x 38" l x 31.5" – 94" (h)

- (74cm (w) x 97cm (l) x 80cm – 239cm (h))

Total weight (cart and imager): ~950 lbs (430kg)

Fits through 32" door (81cm)



**At lowest lift position -
31.5" (80 cm) height**



**At highest lift position -
94" (239 cm) height**

AXISS: Elevation and Source Rotation



AXISS: Other Inspection Targets



Scanning odd shaped objects such as bicycles or wheelchairs for drugs or explosives



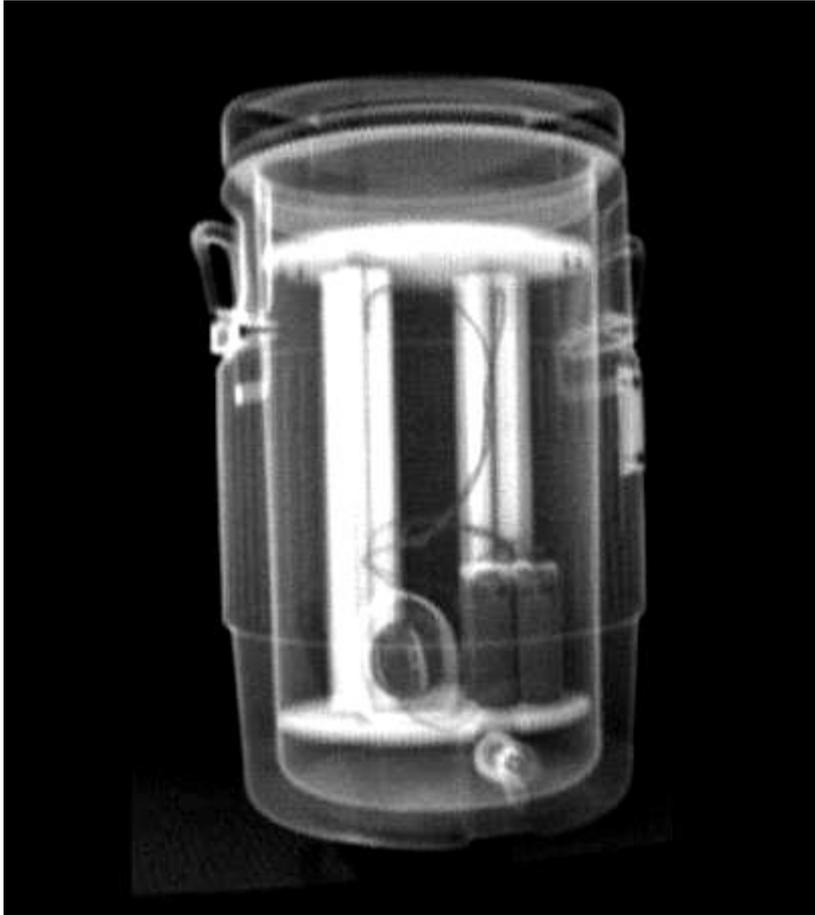
AXISS: Abandoned Packages – High Resolution



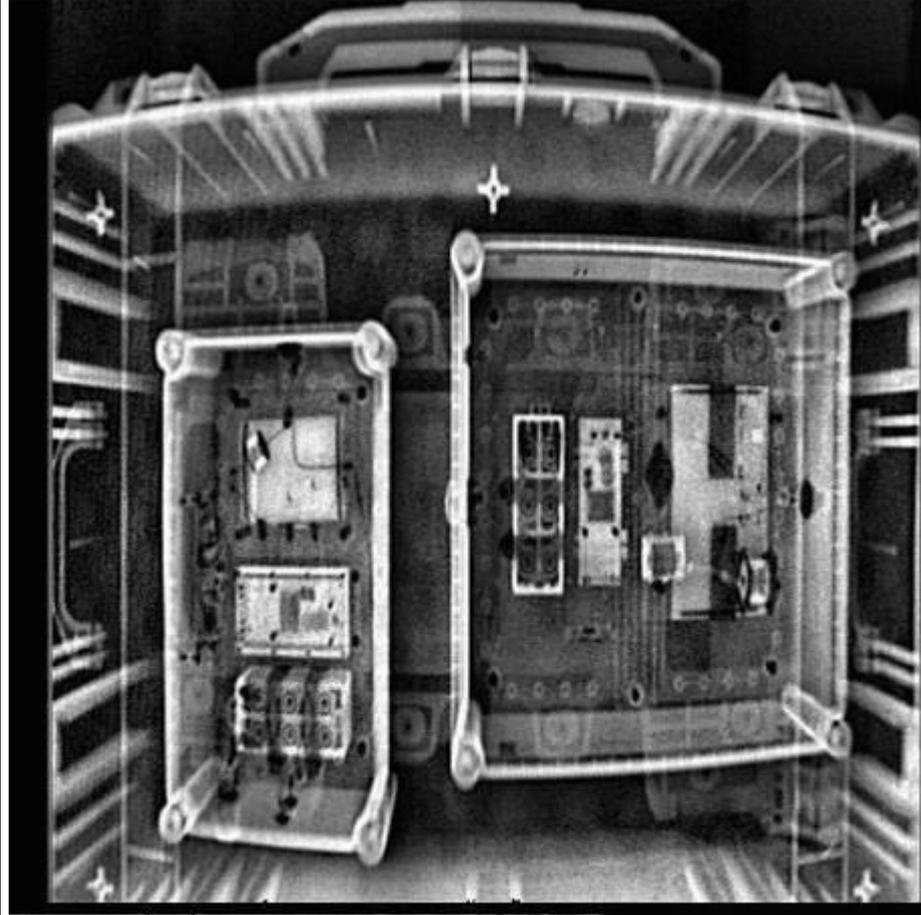
AXISS: High Resolution Imaging Capability



The AXISS systems can take images at <2 mm resolution.



High Resolution - Standalone IED



High Resolution - Electronics

The AXISS Family of Small Modular Backscatter Systems



AXISS development in partnership with DHS/TSWG

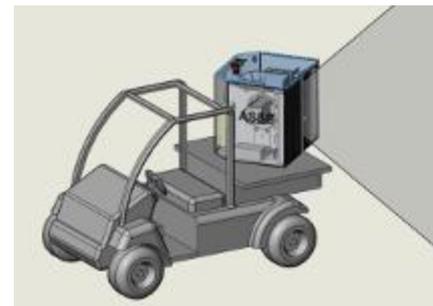
- AXISS RT (Robot Towed):
 - ▶ First miniaturized system, custom designed for bomb squad applications
 - ▶ Robot towed for remote examination of suspect vehicles
 - ▶ Developed under TSWG/NIJ contract
- AXISS:
 - ▶ Slightly larger, more powerful version
 - ▶ Mounted on a powered handcart with lift
 - ▶ Being developed under DHS S&T contract
- Modular Configuration
 - ▶ Same imaging box as AXISS but capable of flexible deployment modes
 - ▶ Being developed under DHS S&T contract



AXISS RT



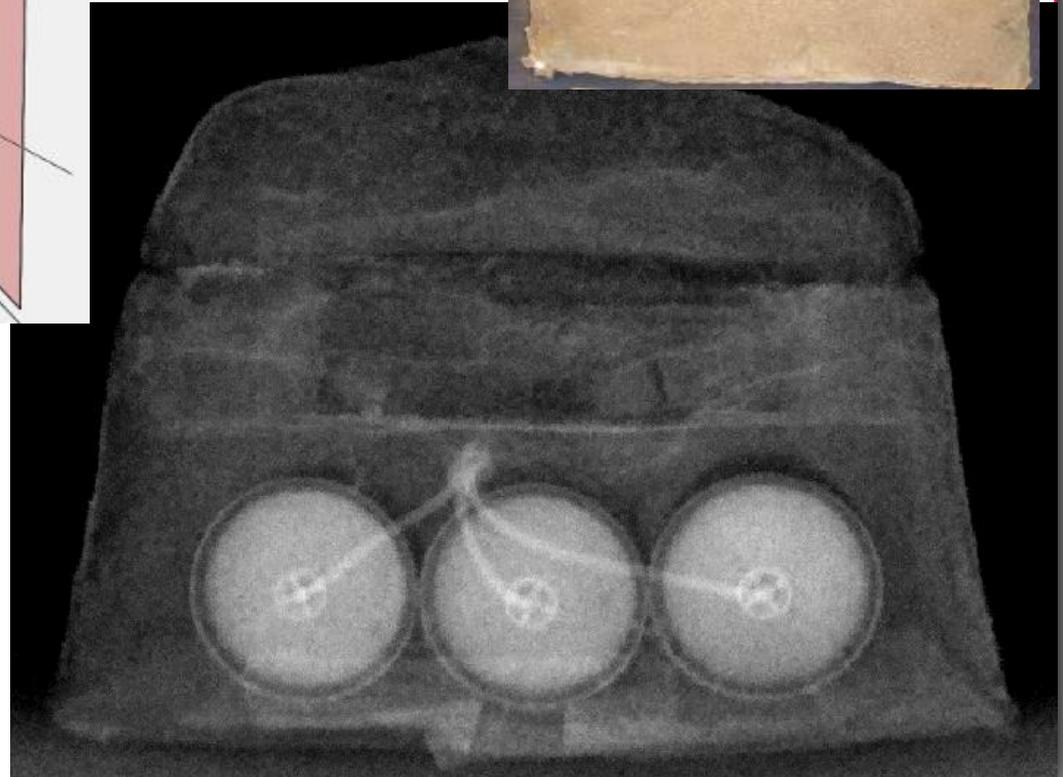
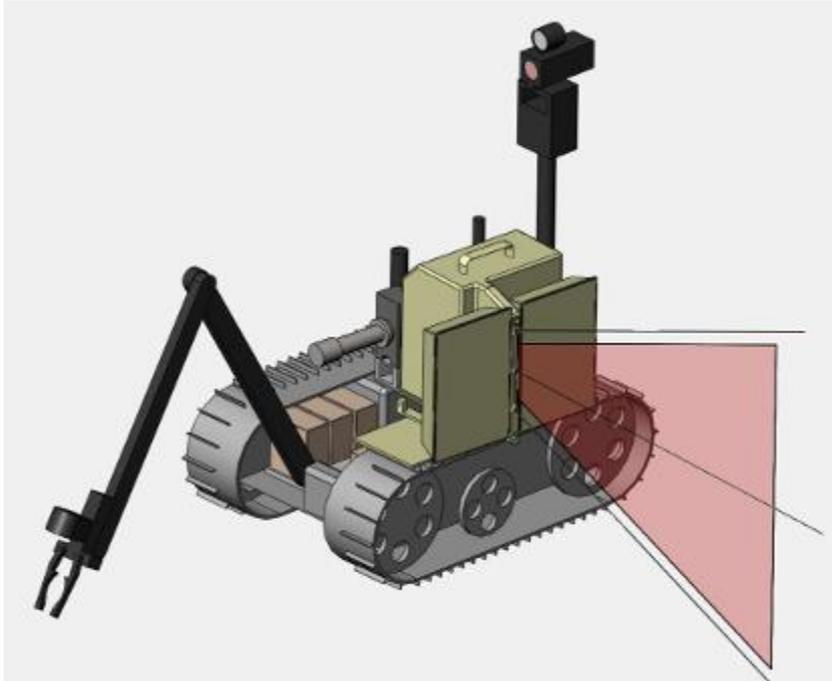
AXISS



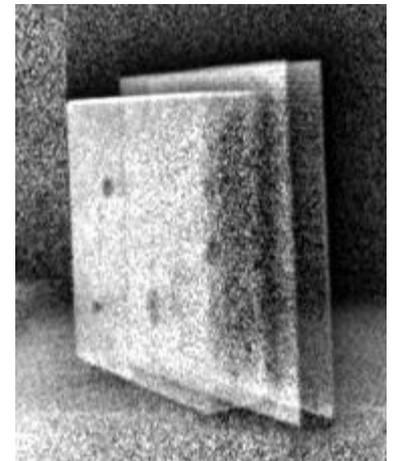
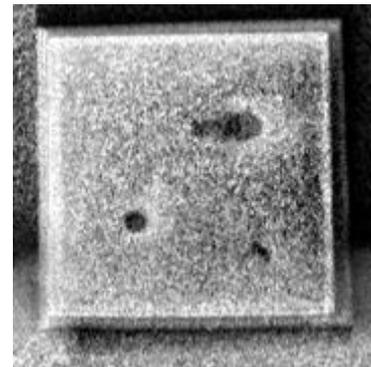
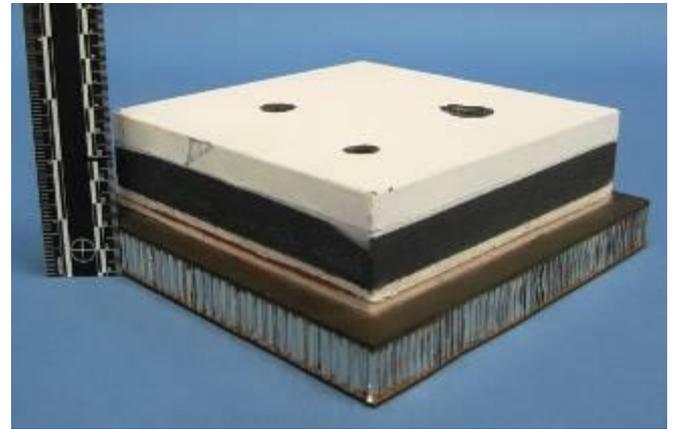
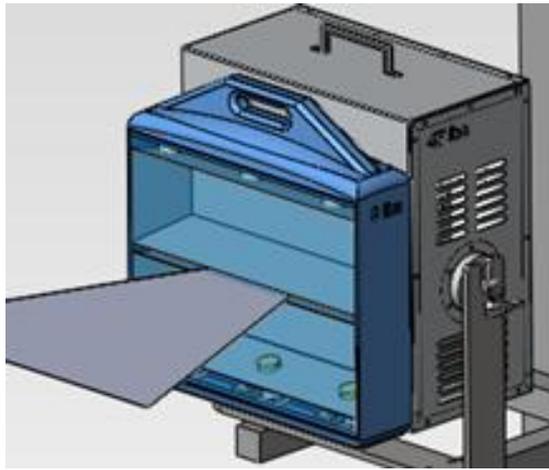
Modular Configuration

70 kV

70 kV: Robot Carried for Military EOD Inspection



70 kV: Man Portable for Versatile Applications



Overview: What system is best for which application?



X-Ray Energy

- ZBV - 225 kV – Enough penetration to see into an ISO container.
- AXISS - 140 kV – The minimum needed to see into a car.
- Portable Bx - 70 kV – No steel, but fine for many other materials (Al, plastic, wood, composite)

X-Ray Power

- ZBV - 3000 Watts – Capable of imaging a car in just a few seconds.
- AXISS - ~500 Watts – Much slower than a ZBV, with typical car images in 60-120 seconds.
- Portable Bx - ~200 Watts – Because targets will typically be close, more power is not needed.

System Size and Weight

- ZBV – Dedicated van/truck, or same capability in stationary portal.
- AXISS – Small enough for transport in a trailer, and easy to maneuver around a site.
- Portable Bx – Concept design is <75 lbs for easy transport and deployment by a single operator.

SAT

Scatter Attenuation Tomography (SAT)

SAT is a technique for performing a single-sided attenuation measurement of a bulk material.

In SAT, low energy X-rays are sent into the target at low dose as two separate beams

The X-rays scatter off the target and are collected by two tightly collimated energy sensitive detectors

Comparing the X-rays from the 4 scatter volumes allows calculation of material properties such as density and atomic number

Due to the geometry, the attenuation measurement is not affected by the composition of any barrier between the source and target material

